KSTAR

KSG-10K/12K5/15K/17K/20K

Solar Inverter

User Manual

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1. Introduction for Signs

In order to make a better use of this manual, please read the following sign explanation carefully.

Warning!

This sign indicates that it may cause danger to safety of users and/or attentions or instructions for possible serious damage to hardware.

Instruction!

This sign indicates important attentions required for good operation of the system.

2. Introduction

2.1 Preface

Dear users, thank you for using photovoltaic grid-connected inverter products manufactured by Kstar which is experienced in development of photovoltaic grid-connected generating sets. We hope this product can meet your demands and welcome you to put forward more suggestions on performance and functions of this product.

2.2 PV Grid-connected Generating System

The photovoltaic grid-connected generating system is composed of solar cell module, grid-connected inverter, metering devices and power distribution system (as shown in Figure 1). The solar energy is converted to DC electric power through solar cell module, which is further converted to sine-wave current synchronous with grid frequency and phase via grid-connected inverter. Such electric power is then fed into power grid. The photovoltaic grid-connected inverter is the key equipment in solar power system.

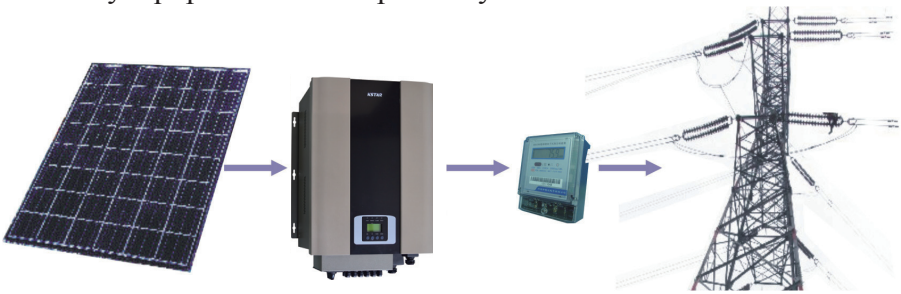


Figure 1: Application of Photovoltaic Grid-Connected Inverter in Photovoltaic Generating System.

2.3 How to Use This Manual

This manual aims to provide detailed product information and installation & use instructions for users of KSG-10K/12K5/15K/17K/20K photovoltaic grid-connected inverter manufactured by this

company. Please read this manual carefully prior to use of this product and store it properly in a place where it is convenient for installation, operation and available for maintenance personnel.

3. Safety Instructions

- ► Please read this manual carefully prior to installation. This company assumes no responsibility for quality assurance upon equipment damage due to installation failing to follow instructions in this manual.
- ► All operations and wiring shall be conducted by professional electrical or mechanical engineer.
- ► Do not move other parts inside the machine case except the binding post during installation.
- ► All electrical installations must conform to local standards for electrical installation.
- ► Please contact with local appointed personnel for system installation and maintenance if this equipment requires the maintenance.
- ► Use of this equipment for grid-connected power generation must be approved by local power supply departments.
- ► When the photovoltaic array is installed in the day, it shall be covered with lightproof materials; otherwise the array end will subject to high voltage under exposure of sunlight, thus causing personal risk.

Warning! Ensure that the input DC voltage does not exceed 900V since higher input voltage may damage this equipment permanently and causing other losses, under which circumstance, this company assumes no responsibility for quality assurance and joint responsibility

4. Overall Introduction

4.1 Circuit Structure

Figure 2 shows main circuit of KSG-10K/12K5/15K/17K/20K inverter by which the direct current is input via three-phase full-bridge circuit and transformed into sine-wave current through filter and output to power grid. To make the photovoltaic array generate in maximum power, the new type power devices are adopted for this machine and the advanced MPPT algorithm is used at the DC side.

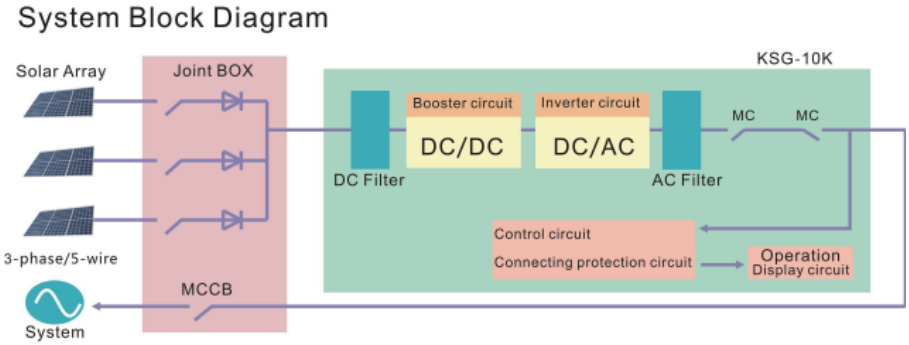


Figure 2: Main Circuit of KSG-10K/12K5/15K/17K/20K Inverter

4.2 Description for External Interface

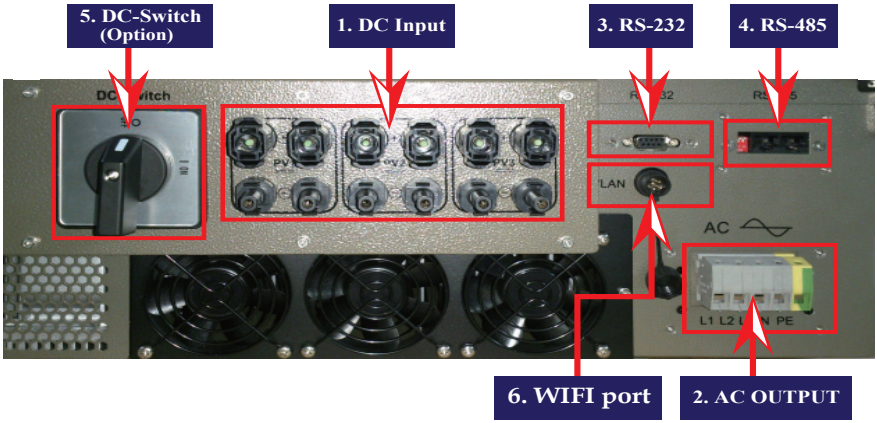


Figure 3: Interface of KSG-10K/12K5/15K/17K/20K Inverter

■ Instructions for Interface

► 1: DC Input: DC input terminal, connected to positive and negative electrode input of photovoltaic array respectively.

► 2: AC OUTPUT:AC output, spaced by three phases AC switch and connected to L1, L2, L3, N and GND of three-phase grid.

► 3: Communication Interface RS232: connected with PC via joint RS232.

► 4: Communication Interface RS485: wire RS485A/B is connected with PC via converter RS485/ RS232.(When two or more inverters are in parallel communication, 2P DIP switch beside RJ45 of the last one should be “ON”. Or else, it may cause communication interruption.That 2P DIP switch is on, means connecting a 120Ω communication terminal resistance between the R/T + and R/T -)

► 5. DC switch: can judge the positive and negative electrode input of photovoltaic array(option).

► 6. WIFI port.(option)

The inverter is equipped with WIFI port. If you need to use WIFI function, please choose to use the External WIFI & Ethernet Box. WIFI communication can be single or network used, 32 PCs at most.

5. System Operation

5.1 System Mode

The operation modes of KSG-10K/12K5/15K/17K/20K grid-connected type inverter include the initialization, waiting, self-checking, grid-connected operating and error modes.

- ► Initialization mode: the internal data will be initialized upon power on of controller.
- ► Waiting mode: the inverter will be under waiting mode if the output voltage of PV battery board is low and it has not detected any fault.
- ► Self-checking mode: self-checking will be conducted by inverter each time prior to grid-connected operation. The inspection items include: inspection on insulation impedance at DC side, self-checking for leakage current detection function and inspection on AC output relay.
- ► Grid-connected operating mode: the direct current of PV battery board is converted to alternating current by the inverter for grid-connected operation. The advanced MPPT algorithm is adopted for controller, making the inverter operating at the maximum power point of PV arrays.
- ► Error mode: the inverter will enter error mode when grid voltage/ frequency is abnormal or fault arises during grid-connected process. At this time, it will stop transformation of electric energy and cut away from the grid.

5.2 Grid-connected Operation

Prior to grid connection of the inverter, please confirm if the wirings among input side of inverter, PV arrays, output side and power grid are all correct. Three kinds of modes are optional for connection between DC input side of KSG-10K/12K5/15K/17K/20K grid-connected inverter and PV arrays:

► Independent input mode: three groups of different PV arrays may be connected to input end of inverter and independent MPPT controller is available for each group of PV arrays to control grid-connected operation.

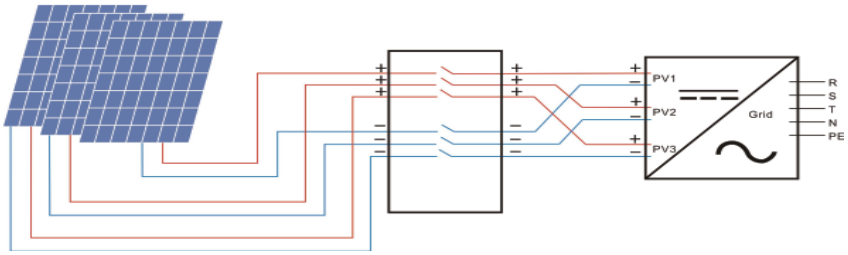


Figure 4: Independent Input Mode

► Parallel input mode: only one group of PV arrays is connected with input end of the inverter, which is then connected to input side of inverter via three groups of parallel input terminals.

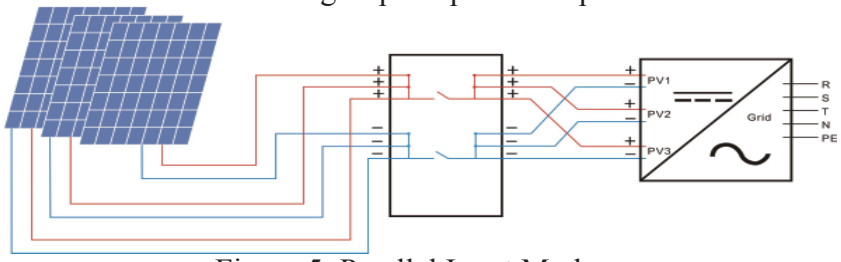


Figure 5: Parallel Input Mode

► Mixed input mode: two groups of different PV arrays may be connected to input end of inverter, where one group of PV arrays is required to lead out two lines of parallel input terminal and connected to terminal PV1/PV2 at input side of inverter, while the other group is connected to terminal PV3 at input side of inverter.

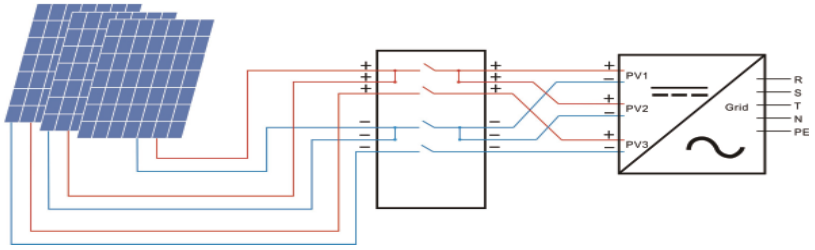


Figure 6: Mixed Input Mode

Users are required to set the item “Input Mode” under LCD menu correctly based on actual conditions of photovoltaic generating system and confirm that the mode of connection at input side is consistent with setting (refer to 7.4.1).

If both input and output wirings are correct and the power grid is free of abnormal conditions, the inverter will enter waiting mode. The grid connection of inverter will be started fully automatic. After PV voltage is higher than Vpv, count down for grid connection will be started automatically for controller and prepare for grid-connected operation after delayed for Td. Manual setting is available for both Vpv and Td through LCD panel.

5.3 System Shutdown

If grid-connected power of inverter is smaller than 100W continuously, the alarm of “zero power” will emerge. After alarming for one minute, the inverter will cut away from the grid and reenter waiting mode.

The inverter will cut away from the grid upon discovery of any abnormal condition during the grid-connected process.

5.4 Error and Alarm

The error and alarm information of KSG-10K/12K5/15K/17K/20K photovoltaic grid-connected inverter refer to the following table:

Table 5.1 Working conditions and fault/alarm message

Working conditions	Message display in English	Description
Normal working status		
Inverter OFF	No display	PV voltage <180V,the inverter is switched off
Inverter Stand-by	Stand-by	210V< PV voltage <350V(adjustable)
Self-test	Checking	PV voltage >350V(adjustable), the inverter get started and self-test all modules

Normal Power Generation	Normal	Generate AC power and feed to municipal Grid after self-test is completed
Monitoring parameter display		
Instant Power Rate & Volume Of Power Generated	XXXX W/ XXXXX Kwh	Instant power rate & accumulated power generated
Voltage And Current Of PV1/PV2/PV3 Input	DC: XXX.X VXXX.X A	Voltage and current from PV arrays
Voltage And Current Of AC output	AC: XXX.X V XXX.X A	Grid Voltage and current
System faulty display		
AC Voltage Low	F00	AC Voltage is too low.
AC Voltage High	F01	AC Voltage is too high.
AC Frequency Low	F02	AC frequency is too low.
AC Frequency High	F03	AC frequency is too high.
Bus Voltage Low	F04	Bus voltage is too low.
Bus Voltage High	F05	Bus voltage is too high.
Bus Voltage Abnormal	F06	Positive voltage or negative voltage is too high or too low on bus.
Insulation Impedance Low	F07	PV arrays Insulation impedance is too low.
Input current high	F08	PV Input current is too high.
Reserved	F09	Reserved
Inverter Current High	F10	Inverter current is too high.
Inverter DC Current High	F11	Inverter DC current is too high.
Reserved	F12	Reserved
Heatsink Temperature High	F13	Heatsink temperature is too High.
AC Relay Abnormal	F14	AC relay is abnormal.
PV Input Voltage Low	F15	One of PV input is idle when inverter is set on parallel mode.
Remote Off	F16	Status of inverter is on remote off.
Reserved	F17	Reserved
SPI Communication Fault	F18	Communication fault on control board.
Reserved	F19	Reserved
Leakage Current High	F20	Leakage current is too high.
Self-Checking Failure Of Leakage Current	F21	Self-checking Failure of Leakage Current.
Consistency Voltage Fault	F22	Inconsistent voltage between primary CPU and secondary CPU.
Consistency Frequency Fault	F23	Inconsistent frequency between primary CPU and secondary CPU.

DSP Operation Fault	F24	DSP communication faulty on control board.
DSP Communication Lost	F32	DSP communication faulty on control board.

Table 5.2 Alarm Information

Alarm message	Alarm code	Solutions
Speed Low Of Fan_A	W00	Alarm message for speed low of Fan_A.
Speed Low Of Fan_B	W01	Alarm message for speed low of Fan_B.
Speed Low Of Fan_C	W02	Alarm message for speed low of Fan_C.
Zero Power	W03	It is only a reminding message to show DC inputs very low and inverter is about to shut down.

5.5 Type of system fault and trouble shooting

Table 5.3 Type of system fault and trouble shooting

Trouble Shooting		
	Alarm Message	Solution
System Faulty Or Failure Type	AC voltage & frequency are too high or too low. (F00-F03)	(1)Pease check mains voltage whether it is complied with local safety standard (2)Please check the AC output line is properly connected. Make sure its output voltage to see if it is normal. (3)Disconnect PV input and restart the inverter and check whether fault still exists. (4)Contact with your local distributor if the fault still exists.
	Bus voltage is too high or too low (F04-F05)	(1)Please check the setting of input mode. (2)Disconnect PV input and restart the inverter and check whether fault still exists. (3)Contact with your local distributor if the fault still exists.
	Bus Voltage Abnormal (F06)	(1)Please check the setting of input mode. (2)Please try to restart inverter every few minutes for several times and check whether fault still exists. (3)Contact with your local distributor if the fault still exists.
	Insulation impedance Fault(F07)	(1)Disconnect PV input and restart the inverter and check whether fault still exists. (2)Please measure impedance of PV+/PV- to ground whether is over than 500KΩ. (3)Please contact your local distributor if impedance is less than 500KΩ.

	Input Current High (F08)	(1)Please check the setting of input mode (2)Disconnect PV input and restart the inverter and check whether fault still exists. (3)Contact with your local distributor if the fault still exists.
	Inverter Current High (F10)	(1)Disconnect PV input and restart the inverter after few minutes and check whether fault still exists. (2)Contact with your local distributor if the fault still exists.
	Inverter DC Current high (F11)	(1)Disconnect PV input and restart the inverter after few minutes and check whether fault still exists. (2)Contact with your local distributor if the fault still exists.
	Heatsink Temperature High(F13)	(1)Disconnect PV input and cool down the inverter then restart the inverter to see if it is back to normal operation. (2)Please check environmental temperature whether out of working temperature. (2)Contact with your local distributor if the fault still exists.
	AC Relay Fault (F14)	(1)Disconnect PV input and restart the inverter and check whether fault still exists. (2)Contact with your local distributor if the fault still exists.
	PV Input Voltage Low (F15)	(1)Please check the configuration of PV input, one of PV input is idle when inverter is set on parallel mode. (2)Disconnect the PV input and restart the inverter and check whether fault still exists. (3)Contact with your local distributor if the fault still exists.
	Remote Off (F16)	The inverter is on remote OFF status, the Inverter can be turned off/on remotely by monitoring software.
	SPI communication Fault (F18)	(1)Disconnect PV input and restart the inverter and check whether fault still exists. (2)Contact with your local distributor if the fault still exists.
	Leakage Current High (F20)	(1)Disconnect PV input and restart the inverter and check whether fault still exists. (2)Contact with your local distributor if the fault still exists.
	Leakage Current Self-Checking Failure (F21)	(1)Disconnect PV input and restart the inverter and check whether fault still exists. (2)Contact with your local distributor if the fault still exists.
	Consistency Voltage Fault (F22)	(1)Disconnect PV input and restart the inverter and check whether fault still exists. (2)Contact with your local distributor if the fault still exists.
	Consistency Frequency Fault (F23)	(1)Disconnect PV input and restart the inverter and check whether fault still exists. (2)Contact with your local distributor if the fault still exists.
	DSP Operation Fault(F24)	(1)Disconnect PV input and restart the inverter and check whether fault still exists. (2)Contact with your local distributor if the fault still exists.
	DSP communication Lost (F32)	(1)Disconnect PV input and restart the inverter and check whether fault still exists. (2)Contact with your local distributor if the fault still exists.

6. Human-machine Interface

6.1 LCD controlled panel

There are 4 buttons and 4 LEDs installed on the panel of KSG-10K/12K5/15K/17K/20K inverter, as shown in Figure 7.

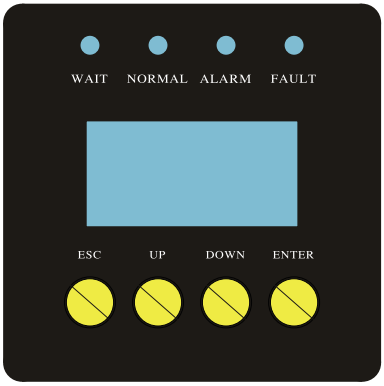


Figure 7: LCD Controlled Panel

Table 6.1 Description for LED light

LED light	Definition
WAIT	Indicator light for waiting of paralleling in
NORMAL	Indicator light for normal operation (generating electricity)
ALARM	Indicator light for warning alarm
FAULT	Indicator light for error (fault)

Table 6.2 Description for functions of buttons

Buttons	Functions
ESC	Return/Cancel/Exit
UP	Upwards choice menu/increase value when setting parameters
DOWN	Downwards choice menu/decrease value when setting parameters
ENTER	Enter menu/confirm set value/move cursor

Note: press any button, backlight of LCD will last for a certain period, specific time can be set in the menu.

6.2 Networking for monitoring

The inverter is provided with various kinds of communication modes, when the user requires to monitor the running information of photovoltaic power generation system, we will offer the following design scheme for monitoring system.

The maximum distance of RS485 communication is about 1000m, and device number should not be more than 32.

■ Intelligent cluster controller:

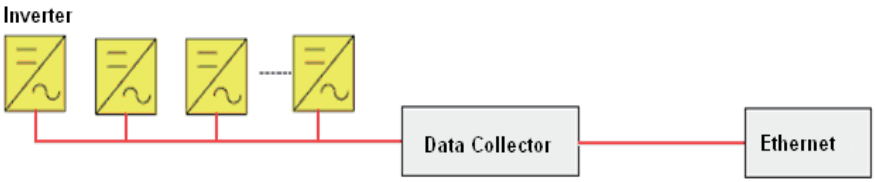


Figure 8: Data collector conducts monitoring through RS485

■ PC machine

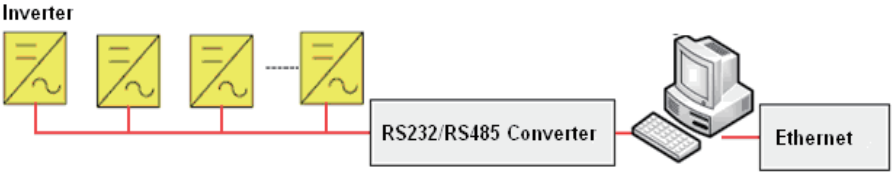
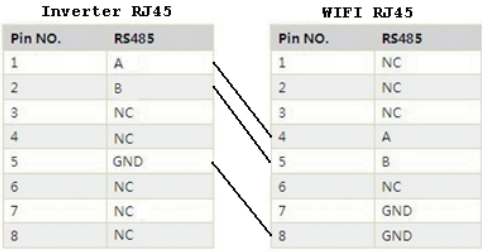


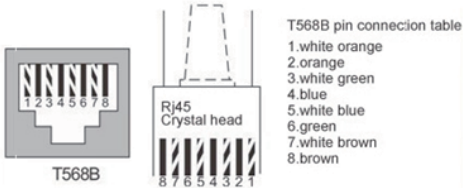
Figure 9: PC machine conducts monitoring through RS485

■ Data collector+ PC machine

Figure 10: Data collector and PC machine conduct monitoring through RS485



Pin corresponding relationship between inverter and GPRS/ Wifi unit.



Inverter RJ45			Inverter RJ45	
Pin NO.	RS485		Pin NO.	RS485
1	(A)T/R+	▶	1	(A)T/R+
2	(B)T/R-	▶	2	(B)T/R-
3	NC	▶	3	NC
4	NC	▶	4	NC
5	GND	▶	5	GND
6	NC	▶	6	NC
7	NC	▶	7	NC
8	NC	▶	8	NC

Pin corresponding relationship between inverter and inverter unit.

6.3 WLAN (optional)

Equipped with WLAN/WIFI box, the inverter can realize Ethernet wired/wireless multiple computer communication.

6.4 Remote control

The inverter can realize the remote SHUTDOWN and ON and power limit regulatory function by the associated monitoring software.

7. LCD Operation Menu

7.1 Initialization

Interface	Explanation
During initialization… please wait!	After starting-up of inverter, LCD will firstly enter this interface, and deliver parameters required by operation of the machine to DSP.

7.2 Major cycle menu

After initialization, LCD will enter a major cycle menu to display running information of the inverter in a circulating mode, including 10 interfaces for network voltage, frequency of electric network, etc. Time for automatic switch-over between interfaces is 3 seconds, also the interfaces can be switched manually by pressing UP or DOWN buttons, if you want to fix at a certain interface, press ENTER to lock this interface, after successful locking, a lock icon will occur at upper right corner of this interface, press ENTER button again, this interface will be unlocked, and the menu will continue to display in a circulating mode.

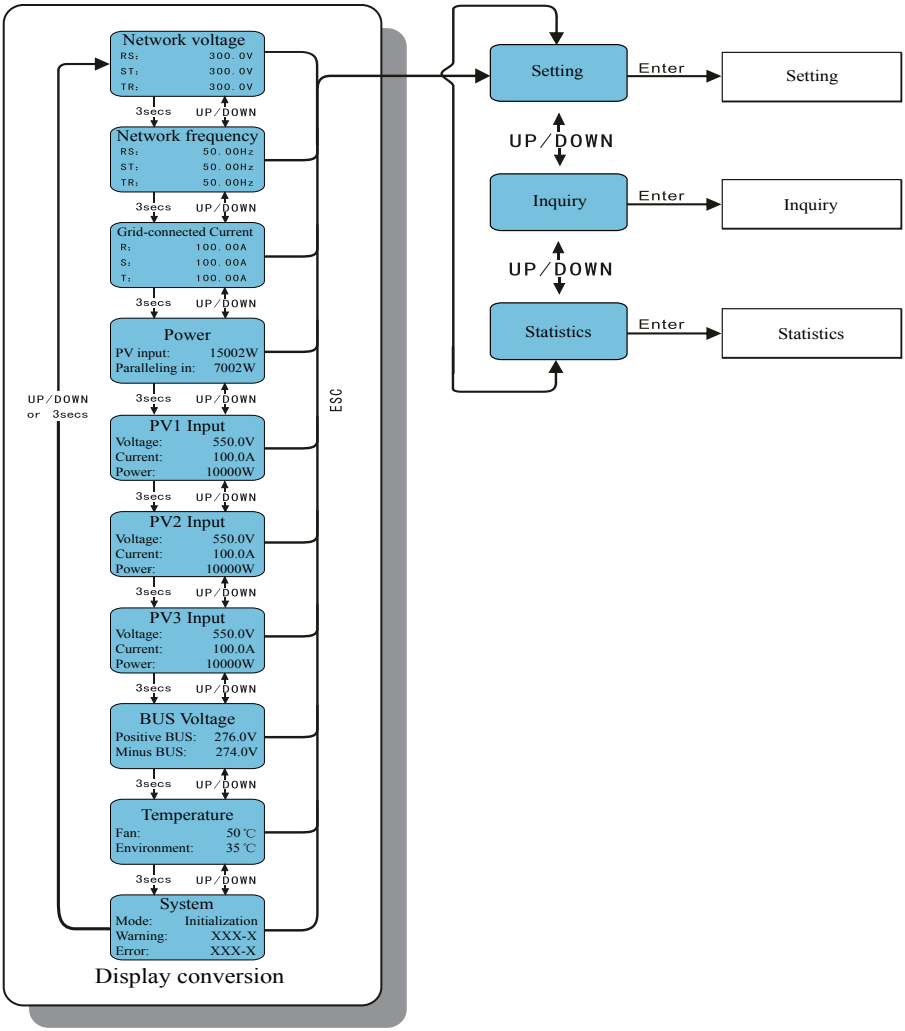


Figure 11: Interface of recycling display

When the menu is in an automatic cycling display mode, if error (fault) or warning alarm occurs, it will skip into system interface immediately and lock to it, and this will make convenience for the user to determine its cause based on codes on the interface. After disappearing of error (fault) or warning alarm, the menu will return to automatic circulating mode. Press ESC button to exit major circulating menu interface and enter user interface (refer to 7.3).

7.3 User interface

Interface	Description
-----User----- → 1:Setting 2:Inquiry 3:Statistics	Select corresponding options by pressing UP or DOWN button, enter “setting”, “inquiry” and “statistics” menus by pressing ENTER button. Press ESC to return major circulating menu.

7.4 Setting

Interface	Description
-----Password----- Input: XXXXX	After entering into the setup interface, the system will prompt to input password, the default password is “000000”, and this password can be altered Password setting menu (refer to 7.4.7); Press UP/DOWN to increase or decrease the input figure, press ENTER button to move the cursor backwards, press ESC button to move the cursor frontward.
-----Setting----- → 1:Input mode 2:Standard for electric network 3:Programmed enable	After successful input of password, it will enter setting option interface. Press UP/DOWN to move corresponding options, and enter the selected menu by pressing ENTER button; press ESC button to return back the user interface (refer to 7.3), there are 11 options in total, including input mode, standard for electric network, programmed enable, working parameters, 485 address, 485 baudrate, display language, LCD backlight, date/time, clear history, password setup.

7.4.1 Input mode

Interface	Description
----- Input mode ----- → 1:Independent 2:Parallel connection 3:Mixed connection	Press UP/DOWN button to move corresponding option. Then confirm the selected option and enter interface of please starting-up again (refer to 7.4.4.7) by pressing ENTER button. Press ESC button to cancel choice and return back setup interface (refer to 7.4). Default option is independent.

7.4.2 Standard for electric network

Interface	Description
------Select------ → 1:China 2:Germany 3:Australia	Press UP/DOWN button to move corresponding options, including China,Germany,Australia,Italy,Spain,U.K.,Hungary,Local; with 11 kinds in total. Then confirm the selected option and enter interface of please starting-up again (refer to 7.4.4.7) by pressing ENTER button. Press ESC button to cancel choice and return back setup interface (refer to 7.4).

7.4.3 Remote CTRL

Interface	Description
-----Remote CTRL ----- → 1:Disable 2:Enable	Press UP/DOWN button to move corresponding options. Then confirm the selected option and return back setup interface (refer to 7.4) by pressing ENTER button. Press ESC to cancel choice and return back setup interface (refer to 7.4). Default option is disability.

7.4.4 Working parameters

Interface	Description
-- Working parameters-- → 1:Starting-up voltage 2:Starting-up timelag 3:Low voltage of electric network	Press UP/DOWN button to move corresponding options, press ENTER to enter into the selected menu; return back setup interface (refer to 7.4) by pressing ESC, there are 6 options in total, including starting-up voltage, starting-up timelag, low voltage of electric network, high voltage of electric network, low frequency of electric network and high frequency of electric network.

7.4.4.1 Starting-up voltage

Interface	Description
---START-UP VOLT--- Input: 350V Unit: V	Press UP/DOWN to increase or decrease the input figure, move the cursor backwards and confirm completion of input as well as enter into interface of please starting-up again (refer to 7.4.4.7) by pressing ENTER button, press ESC to move the cursor frontward and return back working interface (refer to 7.4.4); the input figure is between 350 and 850, default is 350.

7.4.4.2 Starting-up timelag

Interface	Description
-- START-UP DELAY-- Input: 60 Unit: Second	Press UP/DOWN to increase or decrease the input figure, confirm input and enter into interface of please starting-up again (refer to 7.4.4.7) by pressing ENTER button; press ESC to cancel input and return back working interface (refer to 7.4.4), input figure is between 60 and 300. This parameter is changed by grid standards.

7.4.4.3 Low voltage of electric network

Interface	Description
--GRID VOLT LOW-- Input: 187 Unit: V	Press UP/DOWN to increase or decrease the input figure, confirm input and enter into interface of please starting-up again (refer to 7.4.4.7) by pressing ENTER button; press ESC to cancel input and return back working interface (refer to 7.4.4), input figure is between 150 and 210. This parameter is changed by grid standards.

7.4.4.4 High voltage of electric network

Interface	Description
---High voltage of electric network--- Input: 264 Unit: V	Press UP/DOWN to increase or decrease the input figure, confirm input and enter into interface of please starting-up again (refer to 7.4.4.7) by pressing ENTER button; press ESC to cancel input and return back working interface (refer to 7.4.4), the input figure is between 240 and 280. This parameter is changed by grid standards.

7.4.4.5 Low frequency of electric network

Interface	Description
-----VAC-MIN ----- Input: 49.5 Unit: Hz	Press UP/DOWN to increase or decrease the input figure, confirm input and enter into interface of please starting-up again (refer to 7.4.4.7) by pressing ENTER button; press ESC to cancel input and return back working interface (refer to 7.4.4), the input figure is between 45 and 49.8. This parameter is changed by grid standards.

7.4.4.6 High frequency of electric network

Interface	Description
---High frequency of electric network --- Input: 50.5 Unit: Hz	Press UP/DOWN to increase or decrease the input figure, confirm input and enter into interface of starting-up again (refer to 7.4.4.7) by pressing ENTER button; Press ESC to cancel input and return back working interface (refer to 7.4.4), the input figure is between 50.2 and 55. This parameter is changed by grid standards.

7.4.4.7 Please starting-up again

Interface	Description
Please starting-up again!	A prompt that it is required to start the machine once again, so that the setup relevant to working will be effective, and it will return back operational parameter interface (refer to 7.4.4) within 2 seconds.

7.4.5 485 address

Interface	Description
-----485 address----- Input: 1	Press UP/DOWN to increase or decrease the input figure, confirm input and return back setup interface (refer to 7.4)by pressing ENTER button, press ESC button to cancel input and return back setup interface (refer to 7.4); the input numerical value is between 1 and 32.

7.4.6 485 baudrate

Interface	Description
------SELECT------ →1:2400 bps 2:4800 bps 3:9600 bps	Press UP/DOWN button to move corresponding options. And confirm selected option and return back the setup interface by pressing ENTER button (refer to7.4), press ESC button to cancel choice and return back setup interface (refer to 7.4); options include 2400, 4800, 9600 and 19200, with 4 in total.

7.4.7 Display language

Interface	Description
---Display language--- → 1:Chinese 2:ENGLISH 3:DEUTSCH	Press UP/DOWN button to move corresponding options. And confirm selected option and enter into the setup interface (refer to 7.4) by pressing ENTER button, press ESC button to cancel choice and return back setup interface (refer to 7.4).

7.4.8 LCD backlight

Interface	Description
---Backlight time--- Input: 20 Unit: Second	Press UP/DOWN to increase or decrease the input figure, confirm input and return back setup interface (refer to 7.4) by pressing ENTER button, press ESC button to cancel input and return back setup interface (refer to 7.4); the input numerical value is between 20 and 120.

7.4.9 Date/time

Interface	Description
-----Date/time----- Date: 2000-01-01 Time: 02:43:03 Week: 6	Press UP/DOWN to increase or decrease the input figure, press ENTER button to move the cursor backwards, confirm input and return back setup interface (refer to 7.4); and move the cursor frontward and return back setup interface (refer to 7.4)by pressing ESC button.

7.4.10 History clearing

Interface	Description
--- History clearing--- → 1: Cancel 2: Confirm	Clear all records in inquiry/record menu (refer to). Press UP/DOWN button to move corresponding options, and confirm the selected option and enter into setup interface (refer to 7.4) by pressing ENTER; press ESC button to cancel option and return back setup interface (refer to 7.4).

7.4.11 Password setting

Interface	Description
----- Password ----- Old one: XXXXX New one: XXXXX Confirm: XXXXX	This interface will be used to alter password when entering into the setup interface (refer to 7.4). Press UP/DOWN to increase or decrease the input figure, press ENTER button to move the cursor backwards, confirm input and return back setup interface (refer to 7.4); and move the cursor frontward and return back setup interface (refer to 7.4)by pressing ESC button.

7.5 Inquiry

Interface	Description
-----Inquiry----- → 1: INV MODEL 2: MODEL NO 3: FIRMWARE 4: RECORD	Press UP/DOWN button to move the corresponding option, enter into the selected menu by pressing ENTER button; and return back the user interface (refer to 7.3) by pressing ESC button, there are 4 options in total, including INV MODEL,MODEL NO, FIRMWARE and RECORD.

7.5.1 INV MODEL

Interface	Description
-----Inverter----- KSG-10K	This interface displays product Model. of the inverter. UP/DOWN button is invalid, ENTER button is invalid; and press ESC button to return back the inquiry interface (refer to 7.5).

7.5.2 MODEL SN

Interface	Description
-----Inverter----- SN:	This interface displays product series No. of the inverter. UP/DOWN button is invalid, ENTER button is invalid; and press ESC button to return back the inquiry interface (refer to 7.5).

7.5.3 Firmware

Interface	Description
-----Firmware----- ARM Edition: DSP Edition:	This interface displays edition No. of firmware such as ARM and DSP in inverter. UP/DOWN button is invalid, ENTER button is invalid; and press ESC button to return back the inquiry interface (refer to 7.5).

7.5.4 RECORD

Interface	Description
-----Rec(35)----- 1:F01 Date: 2011-10-21 Time: 16:35:26	This interface displays record and its occurring time, including two types of fault and warning alarm, its content will be described in codes, with total number of 500 at utmost, after exceeding this extent, the one with earliest time will be covered. Press UP/DOWN button to look over record backwards or frontward, and press ENTER to enter into explanation interface for corresponding record content, as shown in the following Figure. Press ESC to return back inquiry interface (refer to 7.5).
-----Description----- High voltage of commercial power	This interface is used for Description for the recorded codes. UP/DOWN button is invalid, and ENTER is also invalid; press ESC button to return back to the last interface.
---Numerical value--- Voltage of commercial power 285V	This interface is used for displaying the corresponding specific numerical value when the code generates. For example, producing error code for high voltage value of commercial power, and we can refer to the voltage value of c at that that in this interface. Some codes correspond no numerical values, and then these interfaces are blank. UP/DOWN button is invalid, and ENTER is also invalid; press ESC button to return back the last interface.

7.6 Statistics

Interface	Description
----- Statistics ----- → 1:Time statistics 2:Times of paralleling in 3:Power peak	This interface is used to select various options for statistics. UP/DOWN button is used to move corresponding options, press ENTER button to enter the selected menu; and press ESC to return back the user interface (refer to 7.3), there are 8 options, including time, networking number, total, that day, that week, that month, that year, power peak.

7.6.1 Time statistics

Interface	Description
-----Time----- Operation: 86 Paralleling in: 56 Unit: Hour	This interface displays operational time and generating duration of the inverter. UP/DOWN button is invalid, and ENTER is also invalid; press ESC button to return back statistics interface (refer to 7.6).

7.6.2 Times of paralleling in

Interface	Description
--Times of paralleling in-- Numerical value: 45	This interface displays times of paralleling in for the inverter. UP/DOWN button is invalid, and ENTER is also invalid; press ESC button to return back statistics interface (refer to 7.6).

7.6.3 Power peak

Interface	Description
-----Power peak----- After starting-up: 10645 That day: 9600 Unit: W	This interface displays history power peak and today power peak of the inverter. UP/DOWN button is invalid, and ENTER is also invalid; press ESC button to return back statistics interface (refer to 7.6).

7.6.4 Generated energy of that day

Interface	Description
-----This day ----- Numerical value: 100 Unit: Kwh	This interface displays generated energy of that day. UP/DOWN button is invalid, and ENTER is also invalid; press ESC button to return back statistics interface (refer to 7.6).

7.6.5 Generated energy of that week

Interface	Description
-----This week----- Numerical value: 700 Unit: Kwh	This interface displays generated energy of that week. UP/DOWN button is invalid, and ENTER is also invalid; press ESC button to return back statistics interface (refer to 7.6).

7.6.6 Generated energy of that month

Interface	Description
-----This month----- Numerical value: 3000 Unit: Kwh	This interface displays generated energy of that month. UP/DOWN button is invalid, and ENTER is also invalid; press ESC button to return back statistics interface (refer to 7.6).

7.6.7 Generated energy of that year

Interface	Description
-----This year----- Numerical value: 30000 Unit: Kwh	This interface displays generated energy of that year. UP/DOWN button is invalid, and ENTER is also invalid; press ESC button to return back statistics interface (refer to 7.6).

7.6.8 Gross generation

Interface	Description
-----Total----- Numerical value: 100000 Unit: Kwh	This interface displays gross generation of the inverter. UP/DOWN button is invalid, and ENTER is also invalid; press ESC button to return back statistics interface (refer to 7.6).

8. Installation

8.1 Overview

The installation introduction of KSG-10K/12K5/15K/17K/20K inverter is as follows. Please read this chapter carefully to help you install the KSG-10K/12K5/15K/17K/20K photovoltaic grid-connected inverter correctly.

► **Inspection of damage during transportation**

The KSG-10K/12K5/15K/17K/20K inverter may be damaged during transportation even if we have conducted the test and detection for it before transportation. Therefore, please inspect it before installation. If any damage is detected, please contact with the transportation company or Kstar directly. We will provide you with the best and quickest service after you provide the photo of damaged part.

► **Basic installation requirement**

The KSG-10K/12K5/15K/17K/20K inverter can be installed outdoors with water-proof and dust-proof level of IP65. Some basic installation requirements are as follows:

► It is the best to install it in the place where it is away from the living area due to some noise produced during its operation (<40dB).

► Assure there is no shake in the installation place.

► Assure that the LED light or LCD can be observed conveniently installation place.

► Assure that the ambient temperature is of -20℃~60℃.

► Good ventilation is required.

► Clean installation environment is required.

8.2 Mechanical installation

8.2.1 Installation introductions

For any live part of electronic product, the deadly dangerous may happen due to touch of it. For this product, the voltage of direct current is 900V and the voltage of alternating current is 400V.

Attention!

The professional electrician must be invited to install this inverter.

8.2.2 Mechanical dimension

We offer the dimension of case aiming to create the convenience for your mechanical installation of KSG-10K/12K5/15K/17K/20K inverter. The mechanical dimension of KSG-10K/12K5: **Champagne**: 506×700×210mm in width×height×depth. Its weight is 41kg; **Silver:** 506×695×204mm in width×height×depth. Its weight is 37kg. (The mechanical dimension of KSG-15K/17K/20K: **Champagne**: 522×725×210mm in width×height×depth. Its weight is 46kg; **Silver:** 522×720×204mm in width×height×depth. Its weight is 42kg.)

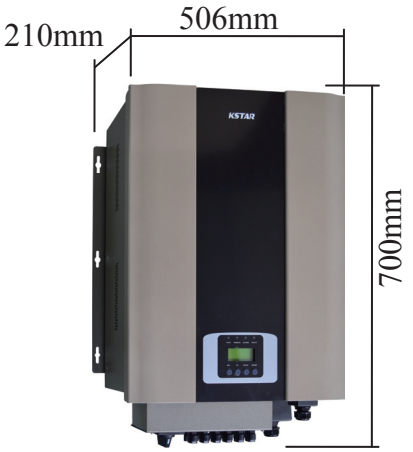


Fig.12 KSG-10K/12K5 Dimension(champagne)

Fig.13 KSG-15K/17K/20K Dimension(champagne)

Fig.14 KSG-10K/12K5 Dimension(silver)

Fig.15 KSG-15K/17K/20K Dimension(silver)

8.2.3 Packing

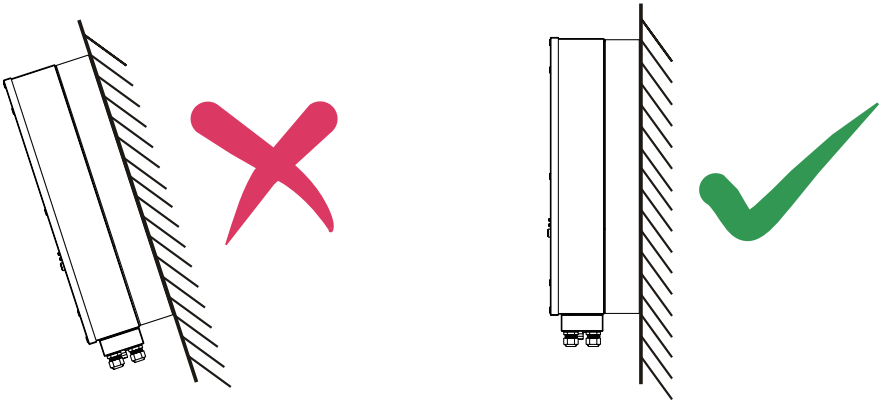
Please check carefully before opening the package of the equipment. It may cause the inverter damage in case the packing material is found damage, please contact with forwarder for claim. If necessary, Please feel free to contact us.

8.2.4 Installation of Inverter

Please read the following installation instruction before you start your work so as to achieve best effect of the inverter.

1. In order to keep long life of inverter, the installation site should be always kept dry.
2. Select suitable location to install the inverter, where is not so easy for pedestrian to touch, but consider easy installation and easy maintenance as well.
3. Make sure the inverter should be kept at least 30CM away from other stuff.
4. Don't directly expose the inverter under the sun light, high temperature will affect the inverter's working efficiency. When the temperature keeps below 40℃, the inverter will be in best working status, the life of inverter will be maximum.
5. Keep good ventilation so as to reduce heat accumulation
6. Once installing inverter in living environment, don't mount it in plastics plate or wooden plate to avoid noise, it is better to mount it on the wall.
7. The inverter generates heat during normal working status, don't install it on a flammable objects or near the place to store flammable materials. Don't install it near potential explosion area.

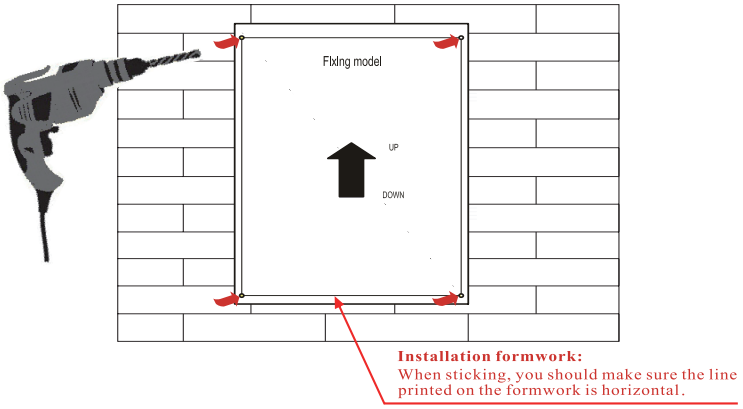
8.2.5 Installation Location



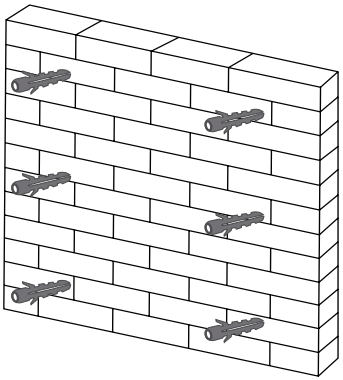
1. The inverter is suitable to be installed on vertical or backwards tilt wall as shown above, the tilt angle should be less 20° .
2. Don't install inverter on forward tilt wall.
3. Don't install inverter on horizontal wall.
4. Mount the inverter at height same as eyesight for easy operation and data reading.

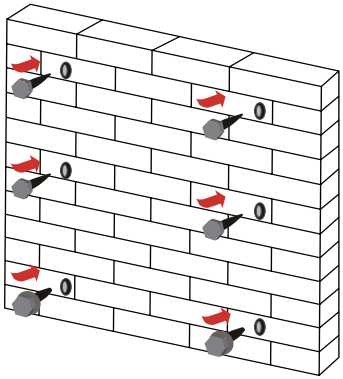
8.2.6 Installation Procedure

1. Stick the installation formwork from the packing list to the wall. Use ∮ 10 driller kit to drill installation holes with reference of the following photo for the correct position.

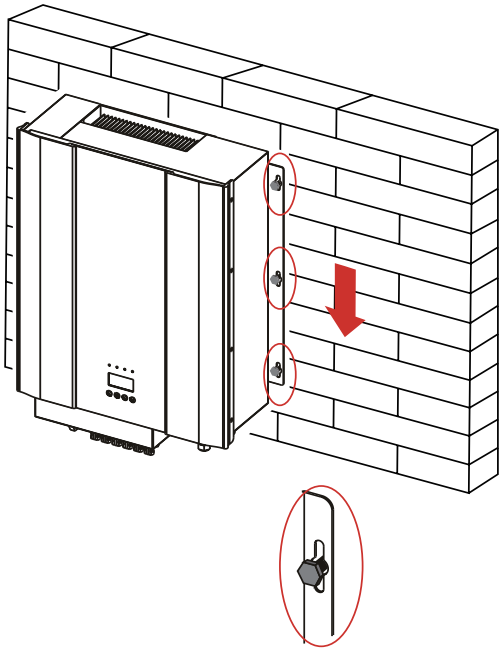

Fixing model
UP
DOWN
Installation formwork:
When sticking, you should make sure the line printed on the formwork is horizontal.

2. Clean the dust inside the holes, and insert expansion pipe into the holes. And then tighten 4 screws into upper four pipes, After tightening, gap between the nut and the wall must than 10mm at least.





3. Hang the inverter onto the 4 tapping screws, and check both sides and keep the inverter in right position, then tighten four tapping screws as shown in following pictures.



8.2.7 Ambient requirement

Attention!

The scope of ambient is -20℃ to +60℃. Meanwhile, no direct sunlight for KSG-10K/12K5/15K/17K/20K inverter should be satisfied, or the high temperature can influence the generated energy.

Warning!

Don't place KSG-10K/12K5/15K/17K/20K inverter with inflammable materials.

Warning!

The temperature of some parts of KSG-10K/12K5/15K/17K/20K inverter is very high. Avoid contacting with them.

8.3 Electric connection

8.3.1 Requirement for electric installation

► **Photovoltaic array**

The open-circuit voltage for photovoltaic array cannot exceed 900V with allocated power for it of 12KW.

Recommended maximum power for photovoltaic array: 12KW

Maximum open-circuit voltage for array: 900V

► **Three-phase grid**

The grid is detected continuously by KSG-10K/12K5/15K/17K/20K inverter to refer to whether it can meet the grid connection condition. The grid limitation for grid condition is as follows. Meanwhile, the grid-connected inverter should be installed with permit of local electric department.

Voltage of three phase grid:	180V~270V
Frequency of grid:	50/60Hz

► **Connected wire**

Select the inner diameter of 12AWG (4mm^2) and the outer diameter of Φ6mm of the photovoltaic cable as the connecting line of the PV input terminal. Select the inner diameter of 10AWG-5AWG (6mm^2-16mm^2) and the outer diameter of Φ16-22mm of the photovoltaic cable as the connecting line of the AC output terminal. Cables should avoid high temperature, flame and rain water whenever possible.

► **Tools**

The multimeter, wire stripper and screw driver are required during electric connection.

8.3.2 Wire for alternating current connection

► The breaker of alternating current is cut off when wiring to assure that there is no electricity at the terminal of alternating current wire. And then, confirm it after measuring of multimeter.

► Connect the “L1” of alternating current output with “L1” of grid;

► Connect the “L2” of alternating current output with “L2” of grid;

► Connect the “L3” of alternating current output with “L3” of grid;

► Connect the “N” of alternating current output with “N” of grid;

► The earth terminal is connected with the land via guide line.

► Confirm that the wiring is firm.

Warning!

Assure there is no live part of KSG-10K/12K5/15K/17K/20K inverter during electric wiring.

8.3.3 Wire for direct current connection

Warning!

The open-circuit voltage of photovoltaic array should not exceed 900V, or the equipment will be damaged. Measure the open-circuit voltage of photovoltaic array with multimeter when connecting.

Warning!

The positive pole and negative pole of voltage for photovoltaic array cannot be reverse, which can be measured with multimeter.

- ► Cut off the distribution breaker of direct current to assure that there is no live wiring of direct current.
- ► Measure the open-circuit voltage for photovoltaic array with multimeter to assure that it cannot exceed 900V.
- ► Confirm the positive and negative pole with multimeter.
- ► The positive pole of photovoltaic array is connected with “DC+” of direct current input
- ► The negative pole of photovoltaic array is connected with “DC-” of direct current input.
- ► Confirm that the wiring is firm.

8.3.4 Wire for communication connection

The communication method of RS485 bus is adopted for this machine when PC is used for monitoring of signal or multiple grid-connected inverters and the RJ45 terminal of terminals for inverter is the port that is used for connection of internal 485 Bus. The monitoring can be fulfilled when PC is connected with RS485 Bus via RS485/ RS232 converter. The wiring diagram of communication system is in Fig. 16. The diagrams for RS485/RS232 converter and RJ45 terminal and 485 bus ports are in Fig. 17 and 18 respectively.

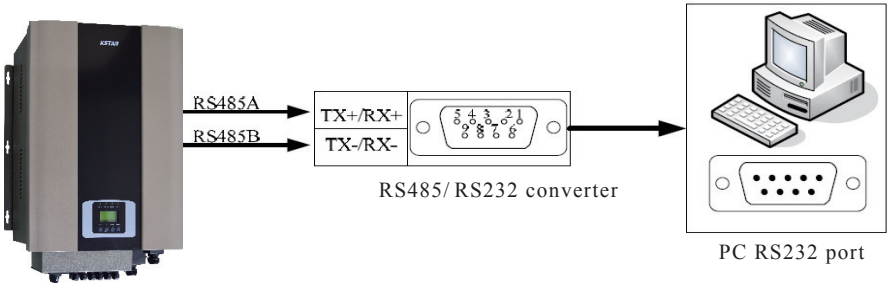


Fig. 16: Communication Connection

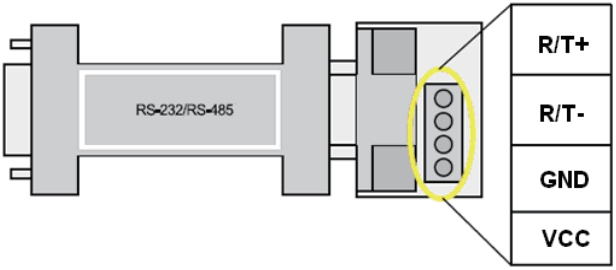


Fig.17: RS485/ RS232 Converter

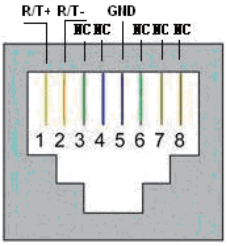


Fig.18: RS485 Port

8.4 Starting and closing

Starting process:

1. Connect the photovoltaic array, KSG-10K/12K5/15K/17K/20K inverter and alternating current grid correctly according to the above-mentioned installation process.
2. Measure whether the voltage of alternating and direct current meets the starting condition of machine with multimeter before starting.
3. First, close the breaker of direct current input.
4. Then, close the breaker of grid.
5. The KSG-10K/12K5/15K/17K/20K inverter will be started automatically and combined to the grid when the conditions for normal operation of machine are satisfied.
6. The grid-connected inverter cannot be controlled manually after its normal operation and it has the functions of automatic starting and closing after fault.

Closing process:

1. The grid-connected inverter will close automatically when the solar cannot meet the requirement for generating.
2. The operation can be performed via LCD on the panel.

Closing process for emergency

Firstly, cut off the breaker of grid and then cut off the breaker of direct current for photovoltaic array if the emergency closing is required, or the direct current breaker will be damaged and the personal hazardous will be produced. Kstar cannot commit the quality assurance and bear any responsibility arising from it due to failure of complying with this requirement.

9. Technical Data

Table 9.1 Technical Data

Input Data	KSG-10K	KSG-12K5	KSG-15K	KSG-17K	KSG-20K
Maximum power of battery	12KW	14KW	17KW	19KW	22KW
Maximum voltage of direct current	900V				
Rated operational voltage	580V				
Tracking scope of voltage	250V~850V				
Full load MPP voltage	300V~750V	350V~750V	400V~750V		
Maximum tracking quantity of power	3				
Maximum input direct current	12A/12A/12A		17A/17A/17A		
Output data					
Rated output power of alternating current	10KW	12K5W	15KW	17KW	20KW
Maximum output current	17A	20A	24A	27A	30A
Allowable voltage scope of grid	323~437V (Refer to Table 9-2)				
Allowable frequency scope of grid	50Hz ±5Hz (Refer to Table 9-2)				
Wired method	L1/L2/L3+N+PE				
THD of output current	<3%				
Power factor	0.9 lead lag				
Maximum efficiency	98.1%				
European efficiency	96.9%				
Mechanical data					
Dimension:champagne/silver (W x H x D)mm	506x700x210 506x695x204		522x725x210 522x720x204		
Weight(champagne/silver)	41Kg/37Kg		46Kg/42Kg		
Protection level	IP65				
Cooling method	Wind cooling				
Characteristic data					
Communication port	RS485/WLAN&Ethernet（Selectable）				
Available ambient temperature	-20℃~+60℃				
Humidity	0~95%, no condensation				
Human-machine operation interface	4 lines of LCD, 4 keys, 4 LED				

Table 9.2 Grid Specification(single-phase)

Grid specification	Output Voltage Range(Vac)	Output Frequency Range (Hz)	Boot wait time (S)	Error recovery time (S)
China	187 - 252	48 – 50.5	60	60
Germany	196 - 264	47.5 – 51.5	60	60
Australia	200 - 270	48 - 52	60	60
Italy	184 - 276	49.7 – 50.3	60	60
Spain	196 - 253	48 – 50.5	180	60
U.K.	184 - 264	47 – 52	180	60
Hungary	196 - 253	49 - 51	300	60
Belgium	184 - 264	47.5 – 51.5	60	60
AUS-W	200 - 270	47.5 – 50.5	60	60
Greece	184 - 264	49.5 – 50.5	180	60
France	184 - 264	47.5 – 50.4	60	60
Local	150 - 280	45 - 55	60	60

In the running process,errors such as AC overvoltage, AC undervoltage, AC overfrequency and AC underfrequency occur ,the DM series go to boot wait time directly after 60 seconds when the power gird returns to normal.

10. Appendix

10.1 Quality assurance

The quality assurance for product of Kstar can be conducted only on the condition that invoice and date when customer purchases the product should be presented and the trade on the product is clear during quality assurance period.

Condition

- ► Kstar will maintain or replace the product having fault with the new one free of charge when the fault is produced during quality assurance period.
- ► The unqualified product after replacing should be returned to Kstar.
- ► The reasonable period must be reserved by customer so that Kstar can repair the equipment having fault.

Kstar has the right to reject the quality assurance when the following conditions appear:

- ► Damage due to transportation
- ► Incorrect installation
- ► Incorrect refit
- ► Incorrect use
- ► Operate it beyond the extreme hostile environment described in this manual.
- ► Install and use it beyond the scope of any provision in relevant international standard.
- ► Damage due to abnormal natural environment.

Please refer to the newest data if product dimension and parameter is changed without prior notice.